WHAT IS CLAIMED IS:

1. A III-V semiconductor laser diode, comprising:

a single or multiple quantum well active region having a p-side and an n-side;

an n-type carrier confinement layer provided on the n-side of the single or multiple quantum well active region;

a p-type carrier confinement layer provided on the p-side of the single or multiple quantum well active region; and

undoped spacer layers provided between the single or multiple quantum well active region and the n-type and p-type carrier confinement layers.

2. The III-V semiconductor laser diode of claim 1, wherein the single or multiple quantum well active region is one of a GaN single or multiple quantum well active region, an InGaN single or multiple quantum well active region, an InAlGaN single or multiple quantum well active region and an AlGaN single or multiple quantum well active region.

3. The semiconductor laser diode of claim 1, wherein the each of the n-type and p-type carrier confinement layers and the undoped spacer layers has an aluminum content which is about 10% to about 30% higher than an aluminum content of the quantum well active region.

4. The III-V semiconductor laser diode of claim 3, wherein the undoped spacer layers have an aluminum content which is about 0% to about 20% lower than the aluminum content of each of the n-type and p-type carrier confinement layers.

5. The III-V semiconductor laser diode of claim 1, wherein a thickness of each undoped spacer layer is between about 2 nm and about 20 nm.

6. The III-V semiconductor laser diode of claim 5, wherein the thickness of each undoped spacer layer is about 4 nm.

7. The III-V semiconductor laser diode of claim 1, wherein an aluminum content of the p-type carrier confinement layer is different than an aluminum content of the n-type carrier confinement layer.

8. The III-V semiconductor laser diode of claim 1, wherein a thickness of the quantum well active region is between about 4 nm and about 20 nm.

9. The III-V semiconductor laser diode of claim 1, wherein a thickness of quantum wells in the multiple quantum well active region is between about 2 nm and about 20 nm.

10. The III-V semiconductor laser diode of claim 1, wherein a thickness of barriers between quantum wells in the multiple quantum well active region is between about 1 nm and about 10 nm.

11. The III-V semiconductor laser diode of claim 1, wherein the barriers between quantum wells in the multiple quantum well active region are undoped.

12. The III-V semiconductor laser diode of claim 1, wherein barriers between quantum wells in the multiple quantum well active region are partially or completely Si-doped.

13. The III-V semiconductor laser diode of claim 8, wherein the thickness of the quantum well active region is about 9 nm thick.

14. The III-V semiconductor laser diode of claim 9, wherein the thickness of the quantum well in the multiple quantum well active region is about 4 nm thick.

15. The III-V semiconductor laser diode of claim 10, wherein the thickness of the barriers in the multiple quantum well active region is about 6 nm thick.

16. The III-V semiconductor laser diode of claim 1, wherein the n-type carrier confinement layer is doped with at least one of Si, O, Se and Te.

17. The III-V semiconductor laser diode of claim 10, wherein the n-type carrier confinement layer is doped to a dopant concentration of between about $2x10^{18}$ cm^{-3} to about $3x10^{19}$ cm^{-3}.

18. The III-V semiconductor laser diode of claim 1, wherein the p-type carrier confinement layer is doped with at least one of Mg, Ca, C and Be.

19. The III-V semiconductor laser diode of claim 12, wherein the p-type carrier confinement layer is doped to a dopant concentration of about $1x10^{19}$ cm^{-3} to about $1x10^{20}$ cm^{-3}.

20. The III-V semiconductor laser diode of claim 1, wherein the single quantum well active region is an InGaN single quantum well active region and the undoped spacer layers and carrier confinement layers comprise InAlGaN.

21. The III-V semiconductor laser diode of claim 1, further comprising:

a p-type waveguide layer provided adjacent to the p-type carrier confinement layer; and

an n-type waveguide layer provided adjacent to the n-type carrier confinement layer.

22. The III-V semiconductor laser diode of claim 21, wherein each of the p-type and n-type waveguide layers comprises AlGaN with an aluminum content of about 6%.

23. The III-V semiconductor laser diode of claim 21, further comprising:

a p-type cladding layer provided adjacent to the p-type waveguide layer; and

an n-type cladding layer provided adjacent to the n-type waveguide layer.

24. The III-V semiconductor laser diode of claim 23, wherein each of the p-type and the n-type cladding layers comprises AlGaN with an aluminum content of about 13%.